

REMARKS

Applicants have now had an opportunity to carefully consider the Examiner's Office Action of June 24, 2003. Reexamination and reconsideration are respectfully requested.

The Office Action

Corrected and substitute drawings received by the U.S. Patent and Trademark Office July 8, 2002 were noted as having addressed the Examiner's objections. However, the Office Action states the objections of the draftsman have not been addressed. Revised formal drawings were mailed October 31, 2002. It is submitted these address all outstanding issues. For convenience, these drawings are resubmitted with this reply.

Claim 16 stands objected to due to "grammatical error."

Claims 5, 9, 10 and 15-18 stand rejected under 35 U.S.C. § 112, second paragraph.

Claims 1-18 were presented for examination.

Claims 1-5 and 16 are rejected under 35 U.S.C. §102(b) as being anticipated by Dhuler et al. (U.S. Patent No. 5,962,949).

Claims 6-10, 12, 17 and 18 are rejected under 35 U.S.C. §102(e) as being anticipated by Moranski et al. (U.S. Patent No. 6,094,289).

Claims 11 and 13 are rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Moranski et al. in view of Dhuler et al.

Claims 14 and 15 are rejected under 35 U.S.C. §103(a) as being unpatentable over Moranski et al.

Prosecution History

On September 4, 2002, a Final Office Action issued in the present case which allowed claims 6-8 and 11-14, and found allowable subject matter as to claims 9, 10, 15, 17 and 18.

In response to the Final Office Action, Applicants submitted three Amendments After Final, and held a telephonic interview. The Examiner issued various Advisory Actions, and an Interview Summary Record. On February 19,

2003, Applicants submitted a Supplemental Information Disclosure Statement. In response to the submission, an Office Action, non-final, was mailed June 24, 2003. That Office Action stated it was responsive to a communication filed on July 8, 2002 (*i.e.*, the Amendment mailed July 1, 2002). It appears none of the Amendments After Final have been entered into the application. Therefore, Applicants are responding based on the claims as they appeared in the July 1, 2002 Amendment.

The Non-Art Rejectionsu

Claim 16 is objected to based on what is argued to be "grammatical error." While Applicants respectfully traverse the Examiner's position on this, in order to move the prosecution forward, Applicants have reviewed the newly-added claims and have attempted to remove any such language.

Claims 5, 9, 10 and 17 stand rejected as the use of "the electrical conductive material" was found to have insufficient antecedent basis. Claim 15 stands rejected for insufficient antecedent basis in the use of "the out-of-plane device" and "the horizontal plane."

Claim 16 stands rejected for use of "the out-of-plane micro-device."

Applicants have reviewed the newly-added claims, and have addressed these issues. For the foregoing reasons, the new claims are believed to be in proper order.

The Claims Distinguish Over the Cited Art

With attention to rejected independent claim (see new claim 19), Dhuler et al. is applied for disclosing a hinge, which is argued to comprise a silicon-on-insulator wafer including a bottom substrate layer, a middle buried oxide layer and a single crystal silicon device layer; a ribbon hinge structure formed in the device layer of the silicon-on-insulator wafer, wherein the ribbon hinge structure is flexible and capable of movement out of the plane of the device layer; and an electrical conductor carried on at least a portion of the surface of the ribbon hinge structure. Claim 19 further recites that the electrical conductor material is carried on at least a portion of an upper outer surface. Dhuler et al. does not teach this upper outer surface. The Office Action's reliance on FIGURES 4 and 5 of Dhuler et al., does not support the stated conclusion that these figures teach that at least a portion of the electrical

conductor is carried on the upper outer surface. The conductive material 56 of Dhuler et al. is clearly not on an upper outer surface, and if the material was on the upper outer surface, Dhuler et al. would not function as required.

Dhuler et al. discloses the electrical conductor material 56 being embedded within layers 52 and 54. However, the present application teaches the electrical conductor material being "carried on at least a portion of an upper outer surface of the ribbon hinge structure," which distinguishes over the Dhuler et al. structure. This structural difference is further distinguished because the intent of Dhuler et al. would be destroyed if its heater 56 is placed on a surface of the ribbon structure. Particularly since the heater 56 needs to be embedded in Dhuler et al. to cause the bending operation (col. 8, lines 17-30).

Turning to claim 20, this claim has been drafted to reflect the concept of the electrical conductor material configured to pass an electrical signal. This is not taught or fairly suggested by any cited reference. Rather, these references used a power supply to generate heat. This is not a concept related to passing of a signal. Thus, the concepts of claim 19 are not taught by the cited art.

It is, thus, respectfully submitted that claim 20 is also distinguished. Further, as claims 21-23 are dependent from and further define now-distinguished claim 19, it is submitted that these claims are also distinguished.

With attention to rejected independent claim 6 (see new claim 24), Moranski et al. is applied for its disclosure of a micro-assembly, which is argued to comprise a micro-device formed on or in a device layer of a single crystal silicon substrate; a ribbon structure formed on or in the device layer, the ribbon structure having been thinned to a thickness which is less than the thickness of the micro-device; a connection interface providing a connection point between a first end of the micro-device and a first end of the ribbon structure; and an electrical conductor material extending along the ribbon structure toward the micro-device.

With attention to the Examiner's position that Figure 3A of Moranski et al. discloses a ribbon structure 78a formed on or in a device layer, Applicants respectfully traverse this position. As far as can be determined by Applicants' review, Moranski et al. does not disclose the micro-assembly that the present application teaches. Further, the ribbon hinge of the present invention provides a much more flexible mechanism than the cantilever beam taught by Moranski et al.

Examiner alleges that Moranski et al. discloses a connection interface similar to the present application. However, Moranski et al. neither discloses nor points out a connection point between a first end of the micro-device and a first end of the ribbon structure anywhere in its invention. Whereas, the present application clearly shows in Figures 4-8 that there is a connection point between a first end of micro-device 52 and a first end of the ribbon structure 42. The unnumbered area that Examiner points to in Moranski et al. is a part of the cantilever beam 79a that extends the length of the device and a portion of the actuator 78a which does not disclose any isolation regions 57 as in the present application.

Further, it is alleged that Moranski et al. discloses electrical conductor material extending along the ribbon structure toward the micro-device. However, as can be seen by Figures 1, 3a, and 6 of Moranski et al. does not teach any sort of conductor material similar to that in the present application. Whereas, the present application clearly discloses electrical conductor material 65 extending along the ribbon structure 42 toward the micro-device 52, as can be seen in Figures 7 and 8 (claim 24 has been drafted to also emphasize that the conductor carries an electrical signal (see the discussion regarding claim 19). The signal is also noted to be passed to the micro-device. This concept is not taught or fairly suggested by the cited art..

Additionally, the ribbon structure 78a of Moranski et al. is simply one layer of a multi-layer cantilever beam, whereas the present application discloses a ribbon structure formed from the device layer. Applicants submit that the ribbon structure 78a applied to claim 6 is not an operational device. Particularly, having ribbon structure 42 and micro-device 52 formed from the same device layer of the silicon-on-insulator wafer allows for the implementation of a three-dimensional electrically actuated MEMs or micro-assembly. Further, to only apply this single layer of Moranski et al. to address the claim limitations of independent claim 24 destroys the intended structure of Moranski et al.

Specifically, Moranski et al. refers to a cantilever beam 60 that has multiple layers. At the fixed end of the cantilever beam 62, the bimorph actuator 68 is affixed to the top of the beam and a reflective surface 75 partially covers the top of the beam at its free end. The bimorph actuator includes all of the material layers which are stacked atop each other at the fixed end of the cantilever beam 60, including the

beam itself 60, a portion 69 of insulating layer 67, a metal layer 70 on the silicon dioxide, a bimorph material layer 71, and a second metal layer 72 atop the bimorph material (col. 6, lines 10-15). It is respectfully submitted that by attempting to use only one layer of a multi-layer structure, the intended use of the cited patent is destroyed, and therefore such application is inappropriate.

This is specifically true since in this embodiment, the intent of the multiple material layers, which have different thermal expansion coefficients, of the bimorph actuator is to cause the cantilever beam to move when the actuator's temperature is forced to rise and fall (col. 6, lines 1-9). Moreover, the present application teaches an isolation region 57 that is patterned within micro-device 52 to isolate an electrical conductor to be deposited therein from the remainder of the micro-device.

Due to the foregoing reasons, Applicants respectfully submit that independent claim 24, as set forth, is not taught or fairly suggested by the cited art alone or in combination with any other material. It is thus respectfully submitted that claim 24 is now distinguished. Further, as claims 25-36 are dependent from and further define now-distinguished claim 24, it is submitted that these claims are also distinguished.

With further attention to dependent claims 27 and 28, Examiner alleges that Moranski et al. discloses an isolation region formed within the micro-device, in which the electrical conductive material is deposited, and an isolation region formed within the ribbon structure, in which the electrical conductive material is deposited. However, Moranski et al. clearly does not disclose an isolation region as taught by the present application, which can be seen in Figure 3a, which has no isolation region as taught by the present application, as shown in step 66 of Figure 4. Further, Moranski et al. does not disclose an isolation region within which electrical conductor material is deposited.

New independent claim 37 now specifically calls for a micro-assembly which employs an electronic device located in operative connection with the micro-device. Such a concept is not taught or fairly suggested by the cited art. Particularly, through the use of the electrical conductor material, which extends along the ribbon structure and to be powered by a power source, an electronic device such as an actuator may be used to move the micro-device. This concept is not taught or fairly suggested in any of the prior art.

Particularly, Dhuler et al. uses stress created by the application of heat to flex

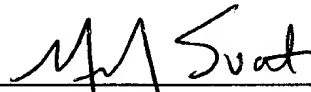
its micro-positioning device. Similarly, Moranski et al. uses a bimorph actuator 68, which is a thermal bimorph actuator having multiple layers with different thermal expansion coefficients. However, the movement of the bimorph material is at or near the anchor portion of the device, and not at the micro-device, such as now claimed in new claim 37. Specifically, neither of these patents show a micro-device in operative connection with an electronic device for causing movement. This is true since the electrical supply necessary for such operation is not taught or fairly considered in any of the references. Any electrical operation in the cited references are to create thermal effects. On the other hand, the electrical conduction in the present application is clearly provided as an electric signal to activate a device. This concept is not taught or fairly suggested by any of the art.

New dependent claim 38, which depends from distinguished claim 37, provides additional concepts not taught by the cited art.

CONCLUSION

For the reasons detailed above, it is respectfully submitted that all claims recited in the application (Claims 19-38) are now in condition for allowance. An early notice to that effect is earnestly solicited.

Respectfully submitted,
FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP



Mark S. Svat
Reg. No. 34,261
1100 Superior Avenue, 7th Floor
Cleveland, Ohio 44114-2579
(216) 861-5582